

Marine Blue-Green Algae from Palawan, Philippines

2. Nostocales and Stigonematales

Isamu UMEZAKI

Department of Marine Bioscience, Faculty of Bioscience, Fukui Prefectural University,
1-1 Gakuen-cho, Obama, Fukui Pref., 917 JAPAN

(Received on August 22, 1994)

In the present paper are enumerated the marine blue-green algae belonging to the orders of Nostocales and Stigonematales. In the Nostocales there are 4 families, 11 genera, and 18 species. Of which four are new to the Philippine marine flora: *Scytonema polycystum*, *Scytonematopsis fuliginosa*, *Calothrix parasitica*, and *Nodularia harveyana*. *Hydrocoryne soluta* (Born. et Grun. ex Born. et Flah.) comb. nov. is established in the Nostocaceae. Two families, 2 genera, and 2 species are listed in the Stigonematales. Worthy of note is the occurrence of subtropical and tropical species such as *Scytonema polycystum*, *Dichothrix penicillata*, *Gardnerula corymbosa*, *Rivularia polyotis*, *Hydrocoryne enteromorphoides* and *H. soluta*, showing subtropical and tropical flora in geographical distribution. (Continued from J. Jpn. Bot. 70:123-139, 1995)

Nostocales (Borzi 1914) Geitl. 1925

Scytonemataceae Kütz. 1843

Kyrtuthrix maculans (Gom.) Umez. 1958 (Fig. 1A)

Puerto Princesa

Cana Is.: On the basal trunk of mangrove, together with *Isactis plana*, 7483b.

Turtle Bay: On rocks in the intertidal zone, 7128, 7468, 7478b, 7481a.

Barangay Ulugan: Oyster Inlet, on rocks in the intertidal zone, 7696b; on aerial roots of mangrove, 7620. Rita Is., on rocks along high tide level, 7634. Sagumay Point, on rocks along high tide level, 7637. Nasudan, on rocks in the intertidal zone, 7640. Marupinas, near Underground River, on rocks in the intertidal zone, 7642.

Roxas (Green Island Bay)

Pandan Is.: On dead coral rocks in the intertidal

zone, together with *Calothrix scopulorum*, 7542b.

Howley Is.: On aerial roots of mangrove, 7396.

San Vicente (Barangay Port Barton)

Capnipa Is.: On rocks along high tide level, 7746.

Punta Burabob: On rocks along high tide level or in the intertidal zone, 7754, 7759, 7768, 7774.

Boayan Is.: On rocks along high tide level, 7660.

Paradise Is.: On rocks along high tide level, 7671, 7672.

Double Is.: On rocks along high tide level, 7730.

Ausan Is.: On rocks along high tide level, 7710, 7725.

Quering Is.: On rocks along high tide level,

7694, 7695.

Velasco Is.: On rocks in the intertidal zone, 7732.

Two forms of fronds were found: One is *Brachytrichia maculans* type, and its fronds are compact, crustaceous, 200–500 μm , sometimes, 800 μm high and this type was found growing on hard rocks; and the other is *Kyrtuthrix dalmatica* type, and its fronds are slightly perforating into lime substrata such as corals and their filaments are irregularly bended in the substratum. The latter type was also found at Union, Nabas, Aklan, Panay Island (Umezaki and Modelo 1987).

Scytonema ocellatum Lyngb. ex Born. et Flah. 1886
Puerto Princesa

Canal Is.: On rocks in the intertidal zone, 7488a.
Barangay Ulugan: Rita Is., On rocks along high tide level, 7636; Oyster Inlet, on aerial roots of mangrove, together with *Scytonematopsis pilosa* and *Blennothrix lyngbyacea*, 7616a, 7623, 7630.

San Vicente (Barangay Port Barton)

Punta Burabob: On rocks and on *Bostrychia* sp. a little above high tide level, 7770, 7775.
Ausan Is.: On woods washed ashore on the beach, 7707.

S. polycystum Born. et Flah. 1886

Puerto Princesa

Barangay Ulugan: Marupinas, near Underground River, on rocks along high tide level, 7654.

Barangay Inagauan: Asinan, on aerial roots of mangrove, 7429a; on spongy mats in the intertidal zone and on the basal trunk of mangrove, 7434; on rocks in the intertidal zone, together with *Bostrychia tenella*, 7439.

Roxas

Howley Is.: On aerial roots of mangrove, 7409.

San Vicente (Barangay Port Barton)

Paradise Is.: On rocks in the intertidal zone,

together with *Lyngbya semiplena*, 7675a.

Scytonema polycystum is new to the Philippine marine flora.

Scytonematopsis fuliginosa (Tild.) Copel. 1936

(Fig. 1B)

Roxas (Green Island Bay)

Johnson Is.: On leaves of seagrass, 7570.

Scytonematopsis fuliginosa is new to the Philippine marine flora.

S. pilosa (Harv.) Umez. et Watan. 1994

Puerto Princesa

Turtle Bay: On rocks in the intertidal zone, 7130, 7478a, 7481b.

Cana Is.: On rocks in the intertidal zone, 7487, 7490a.

Barangay Ulugan: Rita Is., on pebbles along high tide level, 7632a, 7633. Oyster Inlet, on rocks in the intertidal zone, 7612, 7628a; on aerial roots of mangrove, 7616b, 7630b. Marupinas, near Underground River, on rocks in the intertidal zone, 7643.

Barangay Inagauan: Asinan, on the basal trunk of mangrove, 7431, 7424.

Roxas (Green Island Bay)

Howley Is.: On aerial roots of mangrove, together with *Lyngbya aestuarii*, 7398, 7401a, 7402, 7405.

Flat Is.: On aerial roots of mangrove, 7418a, 7419.

San Vicente (Barangay Port Barton)

Punta Burabob: On rocks along high tide level, 7751, 7757, 7762.

Boayan Is.: On rocks in the intertidal zone, together with *Lyngbya semiplena*, 7662a, 7668, 7670.

Double Is.: On aerial roots of mangrove along high tide level, 7705.

Quering Is.: On aerial roots of mangrove, 7681, 7691; among the branches of *Bostrychia* sp. 7697b; on rocks along high tide level, 7699a.

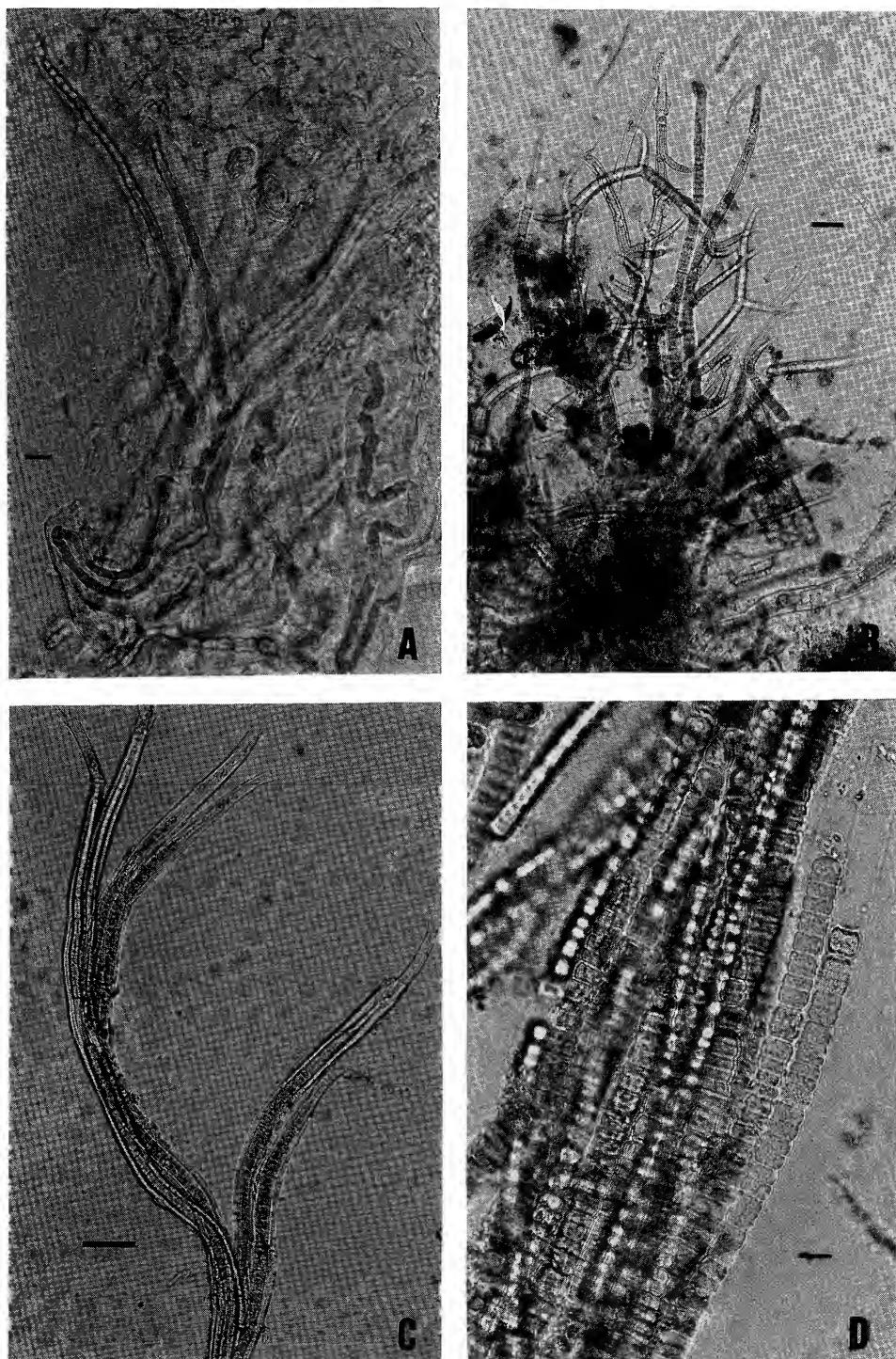


Fig. 1. A. *Kyrtuthrix maculans* (Gom.) Umez., perforating type in coral fragment. B. *Scytonematopsis fuliginosa* (Tild.) Copel. C. *Dichothrix penicillata* Zanard. ex Born. et Flah. D. *Hydrocoryne soluta* (Born. et Grun. ex Born. et Flah.) Umez. Scale bars: A and D, 10 μ m; B and C, 50 μ m.

Velasco Is.: On aerial roots of mangrove, 7684, 7713a; on creeping roots of mangrove in the intertidal zone, 7688a.

Microchaetaceae Lemm. 1910

Microchaetoideae Kom. et Anagn. 1989

Microchaete vitiensis Asken. ex Born. et Flah. 1887

Puerto Princesa

Honda Bay: Cowry Is.: On *Cladophoropsis zollingeri*, 7191.

Barangay Liberty: On dead coral stones in the intertidal zone, 7227.

Barangay Sta. Lucia: On coral reef rocks in the intertidal zone, 7457.

Turtle Bay: On *Gelidium* sp. in the intertidal zone, 7476.

Roxas (Green Island Bay)

Green Is.: On *Cladophoropsis* sp., 7376.

Pandan Is.: On coral rocks in the intertidal zone, 7362.

Johnson Is.: On *Sphacelaria* sp. growing on *Cystoseira prolifera*, 7571.

San Vicente (Barangay Port Barton)

Velasco Is.: On rocks along high tide level, 7736.

Rivulariaceae Kütz. 1843

Calothrix confervicola Ag. ex Born. et Flah. 1886

Puerto Princesa

Honda Bay: Cowry Is., On *Cladophoropsis zollingeri*, 7193.

Turtle Bay: On dead coral stones in the intertidal zone, 7475.

Roxas (Green Island Bay)

Pandan Is.: On *Lophosiphonia villum*, 7358.

Johnson Is.: On *Padina* sp. in the intertidal zone, 7566; on *Gelidium* sp. in the intertidal zone, 7584b; on leaves of seagrass, 7586b.

C. crustaea Thur. ex Born. et Flah. 1886

Puerto Princesa

Puerto Princesa Bay: Pandan Is., on sea mus- sels, together with *Porphyrosiphon lutea*

(=*Lyngbya lutea*), 7175.

Panagtaran Point: On *Mytilus* sp., together with *Lyngbya aestuarii*, 7537.

Barangay Inagauan: Asinan, on the basal trunk of mangrove, 7436.

Roxas (Green Island Bay)

Roxas: On *Cladophoropsis* sp., 7378; on *Dictyosphaeria cavernosa*, 7385.

San Vicente (Barangay Port Barton)

Paradise Is.: On rocks along high tide level, together with *Lyngbya semiplena*, 7676.

Barton: On creeping roots of mangrove along high tide level, 7724.

C. parasitica (Chauv.) Thur. ex Born. et Flah. 1886

Roxas (Green Island Bay)

Green Is.: Among the utricles of *Codium* sp., 7391b.

Johnson Is.: On or among the assimilatory filaments of *Galaxaura* sp. in the intertidal zone, 7584a.

Calothrix parasitica is new to the Philippine marine flora.

C. scopulorum (Web. et Mohr.) Ag. ex Born. et Flah. 1886

Roxas (Green Island Bay)

Pandan Is.: On dead coral rocks in the intertidal zone, 7542a.

Dichothrix penicillata Zanard. ex Born. et Flah. 1886

(Fig. 1C)

Puerto Princesa

Honda Bay: Cowry Is., on rocks in the intertidal zone, 7196.

Roxas (Green Island Bay)

Johnson Is.: On *Padina* sp. in the intertidal zone, 7564; floating as a mass of filaments, 7568.

Purao Is.: On coral stones in the intertidal zone and on leaves of *Sargassum* sp., 7579, 7587.

Roxas: On coral stones in the intertidal zone, 7597b, 7607, 7608; on mollusk shells in the

intertidal zone, 7600.

Cebu

Mactan Is.: On coral rocks in the intertidal zone, 7792.

Specimens (7093, 22 Nov. 1985) reported as *Dichothrix fucicola* (Kütz.) Born. et Flah. by Umezaki and Modelo (1987, p. 112) should be identified with *Dichothrix penicillata* Zanard. ex Born. et Flah. 1886.

Gardnerula corymbosa (Harv.) J. De Toni 1936

Puerto Princesa

Honda Bay: Cowry Is., among the filaments of other filamentous blue-green algae, 7212.

Barangay Sta. Lucia: On the fronds of *Rivularia polyotis*, 7463.

Barangay Ulugan: Marupinas, near Underground River, on rocks in the intertidal zone, together with *Rivularia polyotis*, 7651b. Oyster Inlet, on rocks in the intertidal zone, 7619a, 7628b.

Roxas (Green Island Bay)

Roxas: Among the fronds of *Dichothrix penicillata*, 7602.

San Vicente (Barangay Port Barton)

Ausan Is.: On rocks in the intertidal zone, 7712b.

Quering Is.: On rocks along high tide level, 7699c.

Gardnerula corymbosa, a species of tropical and subtropical marine blue-green algae, is common in Palawan.

Isactis plana (Harv.) Thur. ex Born. et Flah. 1886

Puerto Princesa

Cana Is.: On the basal trunk of mangrove, 7483a.

Barangay Ulugan: Oyster Inlet, on aerial roots of mangrove, 7622. Marupinas, near Underground River, on coral rocks along high tide level, 7644, 7650.

Barangay Inaguan: Asinan, on aerial roots of

mangrove, 7432.

Roxas (Green Island Bay)

Shell Is.: On aerial roots of mangrove, 7556.

Howley Is.: On aerial roots of mangrove, 7404.

Roxas: On dead coral stones in the intertidal zone, together with *Lyngbya semiplena*, 7594, 7598.

San Vicente (Barangay Port Barton)

Velasco Is.: On aerial roots of mangrove, 7685; on rocks along high tide level, 7714, 7737, 7739.

Isactis plana grows in abundance on aerial roots of mangrove or on coral rocks along high tide level, forming patches of 1–2(–3) cm broad.

Rivularia atra Roth ex Born. et Flah. 1886

Syn.: *Rivularia mamillata* Setch. et Gardn. in Gardn., Univ. Calif. Pub. Bot. 6: 475, 1918.

Puerto Princesa

Binunsalian Bay: On coral rocks in the intertidal zone, 7494, 7413.

Barangay Ulugan: Oyster Inlet, on aerial roots of mangrove, 7621. Marupinas, near Underground River, on aerial roots of mangrove, together with *Bostrychia tenella*, 7658.

The Fronds collected in Palawan are 1–2 mm diam. and are usually solitary, or form confluented masses of up to 1 cm diam. *Rivularia mamillata* Setch. et Gardn. in Gardn. 1918 should be combined into *R. atra* Roth ex Born. et Flah. 1886.

R. nitida Ag. ex Born. et Flah. 1886

Roxas (Green Island Bay)

Pandan Is.: On coral rocks in the intertidal zone, 7365.

R. polyotis (Ag.) Born. et Flah. 1886

Puerto Princesa

Honda Bay: Cowry Is., on coral rocks in the intertidal zone, 7184, 7205.

Barangay Sta. Lucia: Kamagong, on coral rocks in the intertidal zone, 7464.

Binunsalian Bay: On coral rocks in the inter-

tidal zone, 7493, 7512.

Barangay Ulugan: Oyster inlet, on rocks in the intertidal zone, together with *Gardnerula corymbosa*, 7629. Marupinas, near Underground River, on rocks in the intertidal zone, 7651a, 7652.

Barangay Inagauan: Asinan, on the basal trunk of mangrove, 7425a; on rocks in the intertidal zone, 7442.

San Vicente (Barangay Port Barton)

Quering Is.: On rocks along high tide level, 7696a.

Nostocaceae Dumort. 1829

Anabaenoideae (Born. et Flah.) Kirchn. 1898

Hydrocoryne Schwabe ex Born. et Flah. 1886

Hormothamnium Grun. ex Born. et Flah. 1886 ("Hormothamnion") and *Anabaenothrix* Randh. 1936 are classified as synonyms of *Hydrocoryne* Schwabe ex Born. et Flah. 1886 by Komárek and Anagnostidis (1989, p. 313).

H. enteromorphoides (Grun. ex Born. et Flah.) Umez. et Watan. 1994

Puerto Princesa

Buguias Is.: On coral rocks in the intertidal zone, 7150.

Roxas (Green Island Bay)

Purao Is.: On the leaves of seagrass, together with *Hydrocoryne soluta*, 7583a.

H. soluta (Born. et Grun. ex Born. et Flah.) comb. nov. (Fig. 1D)

Basionym: *Hormothamnium solutum* Born. et Grun. ex Born. et Flah., Ann. Sci. Nat. Bot. VII, 7: 259, 1888.

Roxas (Green Island Bay)

Purao Is.: On the leaves of seagrass, together with *Hydrocoryne enteromorphoides*, 7583b.

Roxas: On coral reef rocks in the intertidal zone, 7595.

The filaments from Palawan are 12–15 μm diam. and the trichomes are 7.5–10(–12) μm diam. and their

apices are not attenuated. *Hormothamnium solutum*

Born. et Grun. ex Born. et Flah. 1888 is combined in *Hydrocoryne* Schwabe ex Born. et Flah. 1888 in accordance with Komárek and Anagnostidis (1989, p. 316).

Nostocoideae (Borzi 1914) Kom. et Anagn. 1989

Nodularia harveyana (Thw. in Harv.) Thur. ex Born. et Flah. 1886

Puerto Princesa

Binunsalian Bay: On rocks in the intertidal zone, 7509.

Nodularia harveyana is new to the Philippine marine flora.

Stigonematales Geitl. 1925

Mastigocladaceae Geitl. 1925

Brachytrichia quojii (Ag.) Born. et Flah. 1886; Umezaki 1958

Puerto Princesa

Barangay Inagauan: Asinan, on the basal trunk and aerial roots of mangrove, together with *Rivularia atra* and *Bostrychia* sp., 7426, 7433; on rocks in the intertidal zone, 7437, 7441.

Barangay St. Lucia: On coral reef rocks in the intertidal zone, 7465.

Barangay Ulugan: Oyster Inlet, on the aerial roots of mangrove, together with *Bostrychia* sp., 7624. Marupinas, near Underground River, on the aerial roots of mangrove, 7659.

Nostochopsaceae Geitl. 1925

Mastigocoleus testarum Lagerh. ex Born. et Flah. 1886

Puerto Princesa

Barangay Liberty: In dead mollusk shells on coral reef, 7726, 7729; in dead coral stones in the intertidal zone, 7219, 7228.

Barangay Tacan: In dead coral stones in the intertidal zone, 7447.

Sta. Lucas: Rohta Point, in dead mollusk shells, 7460.

Cana Is.: In dead oyster shells in mangrove

forest, 7127, 7482.

Turtle Bay: In dead coral stones in the intertidal zone, 7505b, 7506b, 7507a, 7510, 7514.

Panagratan Point: In dead mollusk shells in the intertidal zone, 7521, 7538, 7539; in dead coral stones in the intertidal zone, 7522, 7534, 7540.

Puerto Princesa Bay: Buguias Is., in the shells of oyster living on intertidal rocks, 7135a, 7136, 7139, 7140, 7144, 7146a; in oyster shells living on aerial roots of mangrove, 7155.

Barangay Ulugan: Oyster Inlet, in dead mollusk shells, 7618; in dead coral stones washed ashore, 7631b. Sagumay Point, in dead mollusk shells, 7638; in dead coral stones, 7639b. Nasudan, in dead coral stones, 7641. Marupinas, near Underground River, in coral rocks along high tide level, 7646.

Roxas (Green Island Bay)

Pandan Is.: In mollusk shells, 7541b; in dead coral stones, 7547b.

Shell Is.: In dead coral stones, 7557b, 7558; in oyster shells living on aerial roots of mangrove, 7559.

Johnson Is.: In dead coral stones in the intertidal zone, 7592b.

San Vicente (Barangay Port Barton)

Cacnipa Is.: In dead mollusk shells, 7747b; in dead coral fragments, 7748b.

Punta Burabob: In dead coral fragments, 7760b; in dead bivalves, 7761, 7764b.

Boayan Is.: In dead coral fragments, 7666b, 7667b.

Paradise Is.: In dead mollusk shells, 7673.

梅崎 勇: フィリピンパラワン島の海産藍藻類.

2. ネンジュモ目及びスチゴネマ目

ネンジュモ目には4科11属18種が記録され, 1新組合せ種 [*Hydrocoryne soluta* (Born. et Grun. ex Born. et Flah.) comb. nov.] が提唱された.

Scytonema polycystum, *Scytonematopsis fuliginosa*,

Double Is.: In dead mollusk shells, 7673.

Quering Is.: In oyster shells living on hanging branches of mangrove just above the sea, 7690a; in dead coral fragments, 7693b; in dead snail shells, 7700b.

Velasco Is.: In oyster shells living on hanging branches of mangrove just above the sea, 7715b; in dead mollusk shells, 7734b; in dead coral fragments, 7726.

Barton: In dead mollusk shells, 7745.

Mastigocoleus testarum is very common in Palawan, where it usually grows in dead or rarely living mollusk shells or in dead coral fragments in the intertidal zone or a little below the intertidal zone.

References

(References cited in "1. Chroococcales and Oscillatoriaceae" are excluded from the following list)

Bornet E. et Flahault C. 1886-1888. Revision des Nostocacees Hétérocystées. I-IV. I, Ann. Sci. Nat. VII. Bot. 3: 323-381 (1886); II, Ibid. 4: 343-373 (1886); III, Ibid. 5: 51-129 (1887); IV, Ibid. 7: 177-262 (1888).

Copeland J. J. 1936. Yellowstone thermal Myxophyceae. Ann. N.Y. Acad. Sci. 36: 1-232.

De Toni J. 1936. Noterelle di nomenclatura algologica VIII. Terzo elenco di Missoficee omomime. Brescia.

Geitler L. 1925. Cyanophyceae. In: Pascher A., Die Süßwasser-Flora 12: 1-450. G. Fischer, Jena.

Randhawa M. S. 1936. Genus *Anabaenothrix* and parallelism in evolution in freshwater algae. Proc. Indian Acad. Sci. 3(5): 407-410.

Umezaki I. 1958. Revision of *Brachytrichia* Zanard. and *Kyrtuthrix* Erceg. Mem. Coll. Agr., Kyoto Univ., Fish. Ser., Special Number: 55-67.

— and Watanabe M. 1994. Enumeration of the Cyanophyta (blue-green algae) of Japan. 1. Chroococcales and Oscillatoriaceae. Jpn. J. Phycol. 42: 175-219

— 1994. Enumeration of the Cyanophyta (blue-green algae) of Japan. 2. Nostocales and Stigonematales. Jpn. J. Phycol. 42: 301-324.

Calothrix parasitica 及び *Nodularia harveyana* はフィリピン新種であった。スチゴネマ目には2科2属2種が記録された。